

# NFAs in OCAML

We describe here our implementation of NFAs in OCAML. The files that implement this are in the `ocaml` folder, namely `nfa.ml` and `nfa.mli`.

The interface is not all that dissimilar:

```
module type NFA =
  sig
    module A : Alphabet.A
    type state = int
    type elem
    type str

    module D : Dfa.DFA with module A = A
                        and type state = state
                        and type elem = elem
                        and type str = str

    type trans = state -> elem -> state list
    type eps_trans = state -> state list
    (* The nfa type *)
    type t

    val make : int -> eps_trans -> trans -> state list -> t

    val epsilonClose : t -> state list -> state list
    val delta : t -> state list -> elem -> state list
    val deltaStar : t -> state list -> str -> state list
    val accept : t -> str -> bool
    val isFinal : t -> state -> bool

    (* Returns the accepted strings of at most given length *)
    val acceptedStrings : t -> int -> str list

    val union : t -> t -> t
    val complement : t -> t
    val concatenate : t -> t -> t
    val star : t -> t
  end

module Make(A : Alphabet.A) : NFA with type elem = A.elem
                                and type str = A.t
```

The first thing that stands out is the use of a “submodule” `D` to represent DFAs on the same alphabet. As every DFA can be considered as a corresponding NFA, this would be handy to have. (In fact we have at the moment omitted a way to obtain an NFA from a DFA, but it could be easily added).

The big change is of course in the transition functions. We separate the “normal” transitions, which are implemented as functions `state -> elem -> state list` from the “epsilon transitions”, which are implemented as function `state -> state list`. The definition of an NFA via the `make` function asks for both. The only other real addition is an `epsilonClose` function, that takes a set of states and computes the epsilon closure of that set.

TODO